

CLAIMS**I CLAIM AS MY INVENTION:**

- 5 1. An insulating ceramic comprising a plurality of partially filled shapes disposed in a binding matrix.
2. The insulating ceramic of claim 1 wherein the plurality of partially filled shapes comprises a dimensionally stabilized array of shapes.
- 10 3. The insulating ceramic of claim 1 wherein the plurality of partially filled shapes comprises shapes selected from the group consisting of oblate spheroid shapes, spheres, and shapes free of corners.
- 15 4. The insulating ceramic of claim 1 wherein each partially filled shape comprises an inner skeleton and an outer skin.
5. The insulating ceramic of claim 4 wherein the outer skin of the shape ranges from about 0.1mm to about 5mm in thickness.
- 20 6. The insulating ceramic of claim 4 wherein the outer skin of the shape ranges from about 0.3mm to about 1.5mm in thickness.
- 25 7. The insulating ceramic of claim 4 wherein the inner skeleton comprises a structure selected from the group consisting of a shaft, a cruciform and a jack-like structure.
8. The insulating ceramic of claim 4 wherein the inner skeleton comprises a foam material.

9. The insulating ceramic of claim 4 wherein the outer skin and inner skeleton comprise an alumina based material.

10. The insulating ceramic of claim 4 wherein the outer skin and inner
5 skeleton comprise an aluminosilicate material.

11. The insulating ceramic of claim 4 wherein the outer skin and inner skeleton comprise distinct materials.

10 12. The insulating ceramic of claim 4 wherein the inner skeleton comprises a silicon based material.

13. The insulating ceramic of claim 4 wherein the inner skeleton is stabilized at a higher temperature relative to the outer skin.

15 14. The insulating ceramic of claim 4 wherein the inner skeleton comprises flyash.

20 15. The insulating ceramic of claim 4 wherein the outer skin comprises a different material than the binding matrix.

16. The insulating ceramic of claim 4 wherein the outer skin of the plurality of partially filled shapes comprises the binding matrix.

25 17. The insulation ceramic of claim 4 wherein the outer skin comprises an encapsulation for the inner skeleton thereby providing environmental and/or chemical protection to the inner skeleton.

30 18. The insulating ceramic of claim 4 wherein inner skeleton fill material volume is in the range from about 5% to about 40% of the volume defined by the outer skin.

18. The insulating ceramic of claim 18, wherein inner skeleton fill material volume is in the range from about 15% to about 20% of the volume defined by the outer skin.

5 20. An insulating ceramic comprising a close-packed array of partially filled spheroids, wherein any spheroid may be partially deformed to at least partially fill a void otherwise formed between adjacent spheroids.

10 21. The insulating ceramic of claim 20 wherein a total volume of voids filled by partially deformed spheroids comprises up to about 27% of the volume of the array.

15 22. The insulating ceramic of claim 4 wherein the plurality of partially filled shapes comprises a plurality of spheroids, and wherein the outer skin thickness is in the range from about 1% to about 30% of the sphere diameter.

23. The insulating ceramic of claim 22, wherein the outer skin thickness is in the range from about 5% to about 10% of the spheroid diameter.